Benefit Analysis of SPC Panel SP-4 Projects& Evaluation of SPC Panel SP-4 Management and Administration

U.S. DEPARTMENT OF THE NAVY
DAVID TAYLOR RESEARCH CENTER
in cooperation with
National Steel and Shipbuilding Company
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FINAL REPORT

✠ ✠ ✠

BENEFIT ANALYSIS OF SPC PANEL SP-4 PROJECTS

and

EVALUATION OF SPC PANEL SP-4 MANAGEMENT AND ADMINISTRATION

✠ ✠ ✠ ✠ ✠

Prepared by
Robinson-Page-McDonough and Associates, Inc.
Post Office Box 9
Greenland, New Hampshire 03840
(603) 436-7762

For
NATIONAL STEEL AND SHIPBUILDING COMPANY
Harbor Drive and 28th Street
Post officee Box 85278
San Diego, California 92186-5278

In Behalf Of
SNAME SPC PANEL SP-4

DESIGN/PRODUCTIONINTEGRATION

Under the
NATIONAL SHIPBUILDING RESEARCH PROGRAM

✠ ✠ ✠ ✠ ✠

September 1993

Task N8-90-11

PREFACE

The National Shipbuilding Research Program has been sponsored during the past 20 years by the Maritime Adrninistration United States Department of Transportation and by the United States Navy toward improving productivity in shipbuilding. The Program is operated through several Panels of the SNAME Ship Production Committee. During 1988 a survey was conducted in behalf of SPC Panel SP-3 on Surface Preparation and Coatings to determine (1) the benefit value that had accrued from the research projects sponsored by that Panel during the previous 15 years, and (2) how the management and administration of the Panel itself- meetings, discussions, activities - was seen by the using community. The report of this survey (NSRP 0303, July 1989) was well received. It was therefore decided to conduct a similar survey for each of the other active SPC Panels.

The survey of SPC Panel SP-4 on Design/Production Integration is reported herein. The purpose of this survey was (1) to determine the type of project most beneficial in the past, and therefore most likely to yield the largest benefit in the future, and (2) to determine how the direction of Panel SP-4 itself might be improved.

The Task was conducted by Rodney A. Robinson, Vice President of Robinson-Page-McDonough and Associates, Inc. Personal interviews were conducted with several representative members of the shipyard Design/Production Integration community to gain the necessary inforrnation. Conclusions and recommendations based on analysis of the findings are included in the report. The work, under NASSCO Purchase Order No. MUl71117-D, began in October 1991 and was completed in September 1993.

EXECUTIVE SUMMARY

This Task has investigated the benefits derived from the projects sponsored during the past 12 years by SNAME Ship Production Committee Panel SP-4 on Design/Production Integration under the National Shipbuilding Research Program. It has found that those projects involving direct shipyard participation have yielded the most value in the shipyard community. The responses from those interviewed endorse the value of such projects, rather than analytical or theoretical exercises which offer little practical application.

This Task has also assessed the opinion of the shipyard using community on the administration and management of Panel SP-4 itself It has found that the practices currently in effect have been well received, and should be continued with only minor improvements. It has also found, however, that there has been an insufficient number of shipyards represented at Panel meetings. This deficiency has produced a non-shipyard bias in Panel deliberations, which has contributed to the minimal shipyard implementation of research results. Although recent attempts to increase the number of shipyards represented at Panel meetings have been effective, continuing efforts are needed to achieve and maintain the desired attendee mix.

The portion of the NSRP within which Panel SP-4 is active takes on additional weight as efforts unfold to prepare our shipyard community for entry into the international commercial market. The current dominance of the European shipyards in that market is well recognized. Recent visitors to several European shipyards have recounted a major reason for their success, perhaps the key to their overwhelming productivity. It is the close and effective relationship that exists among design, engineering, planning, supply, and production activities. This relationship enables an accurate determination that construction activities are fully ready to begin, and will be able to continue without interruption throughout the entire manufacturing cycle, before any work is even started! This means that production efforts will suffer no delays due to missing material, inappropriate design and engineering support, or unrealistic planning, and that there will be no changes in contract requirements in midstream. As a direct result, production momentum can be attained quickly, and be maintained during the entire build cycle, virtually eliminating the numerous costly delays during ship construction with which we are all too familiar. The area of Design/Production Integration has an enormous impact on shipyard productivity. Panel SP-4 surely deserves the involvement and support of everyone interested in preserving the shipyard industry in the United States.

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and

EVALUATION OF SPC PANEL SP-4 MANAGEMENT AND ADMINISTRATION

BACKGROUND

General Discussion

This Project was designed: (1) to investigate the benefits that may have resulted from SPC Panel SP-4 Design/Production Integration projects carried out over the first 12 years of Panel operations; and (2) to evaluate how the management of Panel SP-4 itself is currently viewed by the using community. The aim was to focus on what type of project has been most helpful in the past, and may therefore be presumed to yield the most benefits in the future, and also to explore how the activities associated with Panel SP-4 might be improved.

This Project would consist of interviews with members of the Design/Production Integration community to gain information on these matters. The interviews would be on-site and face-to-face, to yield the most meaningful results. Analysis of findings would be published for principal consumption by SP-4 Panel Members toward their action on panel operations and projects in the future.

This project was a direct follow-on to a similar project conducted in 1989 in behalf of SPC Panel SP-3 to (1) explore the benefits that may have resulted from the projects sponsored by that Panel during the previous 15 years, and (2) to evaluate how the management of Panel SP-3 itself was seen by the using community. The report on that project (NSRP 0303, July 1989) was well received, prompting the development of this current project, which consists of the same kind of analyses for all other SPC Panels, as well as an update on the projects of Panel SP-3 since the original report. The report presented herein covers the area of SPC Panel SP-4 on Design/Production Integration.

Overview

Information on both aspects of this effort was gained through personal and anonymous interviews with 11 members of the Design/Production Integration community from 8 different shipyard locations. Those interviewed were all shipyard people who have been associated with Panel SP-4 activities in the past few years. 9 specific and detailed responses to the questionnaire were gathered, and have been used to formulate the detailed sections of this report. The interviews were conducted during April and May, 1993.

Several questions were designed to explore both aspects of this survey. The worksheets for gathering information on the benefits of individual projects are contained in Appendix A. The worksheets associated with Panel SP-4 direction are contained in Appendix B.

A detailed discussion of the findings is presented below. Those associated with the benefit analysis of panel projects begin on this page. Those associated with panel management begin on page 16. Conclusions reached from the findings are on pages 27 and 28. The recommendations drawn from these conclusions are on page 29.

BENEFIT ANALYSIS OF PROJECTS SPONSORED BY SPC PANEL SP-4

General Discussion

This section contains information on all of the SP-4 projects investigated, including a description of each project, the pertinent information surrounding that project, and an analysis of the benefit value gained from that project to date. The NSRP Number is that assigned to each report in the NSRP Bibliography of Publications 1973-1992, published (now annually) by the University of Michigan for the National Shipbuilding Research Program. The proiects investigated are those listed in this specific Publication (1973-1992). The analysis portion has been drawn from the comments offered by those interviewed, and is intended to provide a general indication of how the project has been received by the shipyard industry. It also indirectly provides the feelings of those interviewed on whether that particular type of effort should be sponsored by SP-4 in the future, since those projects with the higher benefit value might better receive the more favorable consideration. Appendix A was the worksheet used during the interviews.

The display below is intended to provide a rapid visual idea of the relative benefit value that has been gained from the SP-4 sponsored projects that were investigated. While these ratings are surely subjective, they represent the general opinions of those interviewed, which constitute a good cross-section of the shipyard industry in the Design/Production Integration area. As such, these opinions reflect the overall industry attitude surrounding these projects, which should be of interest to SP-4 panel members during consideration of what projects to sponsor in the future. The number of *'s against each project report indicates the amount of benefit gained from it to date. The more *'s, the larger the benefit value gained.

Report No.	Benefit Value	Report No.	Benefit Value
NSRP 0122	****	NSRP 0274	* * *
NSRP 0148	* * * *	NSRP 0285	* *
NSRP 0197	**	NSRP 0286	**
NSRP0236	*********	NSRP 0293	* * *
NSRP0255	*****	NSRP 0300	*******
NSRP 0258	* *	NSRP 0319	***
NSRP 0259	*	NSRP 0323	* * * * *
NSRP 0266	* * *	NSRP 0333	* * * * * *

Detailed Discussion of Individual Projects

Each of the individual projects investigated are discussed below in the chronological order in which they were carried out. Included is: NSRP Number; Benefit Value Rating (*'s); *TITLE; AUTHOR; DATE, COST* (where available); *ABSTRACT* ; and *BENEFIT ANALYSIS.*

NOTE: Appendix C is an abbreviated listing of these same projects (NSRP Number; *TITLE, AUTHOR; DATE; COST)* arranged according to the benefit value (number of *'s) assigned to each project, highest to lowest. Appendix C is included as an aid to understanding which types of projects were found to be of most (and least) interest and value to the using community, based on user comments received during this survey.

NSRP 0122 * * * *

TITLE: Shipbuilding Design/Production Integration Workshop. Vol. I and II.

AUTHOR: Panel SP-4.

DATE: January 1981 *COST:* (Not available)

ABSTRACT: This is a report of the proceedings of a Design/Production Integration Workshop held in Atlanta, Georgia, in January 1981. It was at this workshop that the need was identified for an industry wide approach to this subject. The formation of Panel SP-4 was also recommended for continued program direction in this area. (VOl I. 36 p.; Vol II,36 p.)

BENEFIT ANALYSIS? MIXED VALUE. This report was familiar to 1/3 of those interviewed. The remaining 2/3 had no knowledge of the report and no interest in the material. This Workshop launched Panel SP-4 into operation, but had no direct benefit to the using community as research information.

NSRP 0148 * * * *

TITLE: Design/Production Integration.

AUTHOR: Newport News Shipbuilding.

DATE: March 1982 *COST:* (Not available)

ABSTRACT: This document reports the meeting minutes of the Design/Production Integration meeting which was held in March, 1982. This meeting was a follow-on to the January 1981 workshop. (80 p.)

BENEFIT ANALYSIS MIXED VALUE. This report was familiar to 44% of those interviewed. One of them cited its use in classroom activities at Webb Institute. This meeting served to continue the operation of Panel SP-4, but otherwise there was no reported benefit to the using community from this report.

NSRP 0197 **

TITLE: Software Tools for Shipbuilding Productivity.

AUTHOR: Grumman Data Systems Corp., for Newport News Shipbuilding.

DATE: December 1984 *COST:* $52,340.

ABSTRACT: The objectives of this study are to define and identify software tools, and to impart to the shipbuilding community the knowledge to use them to aid in the design/ production integration of the shipbuilding process. The material presented is followed by a catalog of software tools, and a recommended means of distributing results to the shipbuilding community. A glossary of acronyms is also included. There is no attempt made to specify currently in use, or projected hardware/soflware systems in either the computer, or CAD/CAM device arena. This task has been undertaken in approximately the same timeframe as this study by the CAD/CAM Survey Study performed by the Chicago-based IIT Research Institute which is reported separately. (250p. approx.) (Project identified as 4-82-2.)

BENEFIT ANALYSIS: LOW VALUE. Only *22%* of those interviewed had any knowledge of this report or interest in the material. One person said that he had read the report recently while looking for specific subject matter. No application of the material was indicated.

NSRP 0236 * * * * * * * * *

TITLE: Design for Production Manual -3 Volumes.

AUTHOR: Bethlehem Steel Corporation, Sparrows Point, A and P Appledore Ltd. and J.J. Henry. Co., Inc. for Newport News Shipbuilding.

DATE: December 1985 *COST:* $125,000.

ABSTRACT: This manual is a collection of ideas and techniques involved with shipbuilding, all having the common directive of Design/Production integration. The manual structure and content were developed with representation from large and small shipyards, design agents, and the Maritime Administration to insure that the manual responds to identified needs. It has been produced in three volumes: Volume I Concepts, Volume II - Design/Production Integration, and Volume III- The Application of Production Engineering. (859 p.) (Project identified as 4-82-1 for Phase 1, and 4-83-1 for Phase 2.)

BENEFIT ANALYSIS: HIGH VALUE. 2/3 of those interviewed were familiar with this report, and half of those reported application of the material in their shipyards. One person interviewed had a copy of the report sitting on his desk for ready reference. Another cited use of this material at Webb Institute. A third person said that the material could be useful, but might be too simplistic. Overall, this project received the highest rating within the SP-4 area.

NSRP 0255 * * * * *

TITLE: Product Work Classification and Coding.

AUTHOR: Todd Shipyards Corporation, Seattle, for Newport News Shipbuilding.

DATE: June 1986 *COST:* $139,750. (Phase 2.) (Phase 1 not available.)

ABSTRACT: For many years, group technology has been endorsed by shipbuilders as one of the cornerstones of the shipyard of the future. Tools for implementation of group technology work methods are essential for improvement in the shipbuilding industry because they make technology more accessible. This manual and the classification and coding system contained therein were developed to be used as tools. The manual discusses group technology and its application to shipbuilding. It presents a classification and coding system based upon the concepts of Product Work Breakdown Structure (with examples illustrating its use in manual and computer-aided formats). discusses subjects related to its use. and lists resources for further information. (200 p.) (Project identified as 4-82-3 for Phase 1, and 4-83-2 for Phase 2.)

BENEFIT ANALYSES: MIXED VALUE. 1/2 of those interviewed were familiar with this report. Its use at Webb Institute was cited, although no shipyard interviewee reported use of the material. One person said that this was a good first effort but that it was not at the necessary level of detail to be beneficial.

NSRP 0258 **

TITLE: Specification-Driven Pipe Detail Design.

AUTHOR: Ingalls Shipbuilding, Inc. for Newport News Shipbuilding.

DATE: July 1989 *COST:* $82,742.

ABSTRACT: Traditional shipboard piping design begins with a piping system diagram. The piping system diagram is a drawing, at a level of detail which gives guidance and basic limiting parameters. Consequently, the detailed design products which follow may contain errors, unintended differences from -and contradictions to - the system level design specifications. This study was authorized to determine the feasibility and examine the implications of creating a computer-controlled environment in which the system level design can be programmatically correlated to the detail design. The approach taken would be to create up-front computer-resident sets of piping specifications and design rules. These sets would form the basis for computer software processes and checks, to ensure that detail design practices are not allowed to deviate from the intent of the system design. Performing piping design in such a computer-controlled environment has been titled "specificationdnven design". (110 p.) (Project identified as 4-84-5.)

BENEFIT ANALYSIS: LOW VALUE. 2/3 of those interviewed were familiar with this report. They considered it a good tool, but said that there was no application for it.

NSRP 0259 *

TITLE: Implementation of Advanced Technology in the Shipbuilding Industry - Pilot Workshop Report.

AUTHOR: The University of Michigan for Newport News Shipbuilding.

DATE: April 1987 *COST:* $59,960.

ABSTRACT: This report outlines the development of a pilot workshop on the dynamics of organizational response to advanced technology implementation for the U.S. shipbuilding industry, the tools that were utilized in executing the workshop design, and the lessons learned. The purpose of the workshop was to provide the process for management to gain a better understanding of the consequences of implementing advanced shipbuilding methods into the shipyards. The process used was based on industrial engineering and management science relevant to organizational change. In addition to the tutorial lectures, a series of working sessions is outlined. and recommendations are made for future workshops. (124 p.) (Project identified as 4-85-5.)

BENEFIT ANALYSIS: LOW VALUE. 78% of those interviewed had no knowledge of this report and no interest in the material. One of those familiar with the report said that there was not much value in it. Another said that it was "a standard that did not go anywhere".

NSRP 0266 * * *

TITLE: Computer Aided Process Planning for Shipyards.

AUTHOR: Bath Iron Works Corporation. for Newport News Shipbuilding.

DATE: August 1986 *COST:* $68,237.

ABSTRACT: The future success of the U.S. shipbuilding industry depends on quantum leaps in productivity. The application of group technology (GT), process lanes, accuracy control, and Computer Aided Process Planning (CAPP) are essential ingredients to such productivity increases. Computer Aided Process Planning and its requirement to organize manufacturing data in a logical. structured manner has brought the shipbuilding industry back to the GT concept in the structural fabrication shop. The subdivision of a ship into manageable subsets of interim products allows for the further grouping of interim products into families requiring similar manufacturing processes. This breakdown of parts into families is the tool that ultimately supports the effective implementation of a CAPP system. The introduction of CAPP to a shipyard brings with it a structured discipline that can result in a significant productivity increase. (400 p.) (Project identified as 4-83-4.)

BENEF7T ANALYSIS: LOW VALUE. Although 56% of those interviewed were familiar with this material and interested in it, no actual application of it was reported. Two people said that application might be considered in the future. One person said that this material “has not made it yet”.

NSRP 0274 * * *

TITLE: Shipyard Engineering and Planning Organizations.

AUTHOR: Bath Iron Works Corporation.

DATE: August 1987 *COST:* $62,780.

ABSTRACT: U.S. shipyards have recognized the advantages of zone-oriented production methods and are using them to some extent. This research study analyzes and compares current planning and engineering organizations in both U.S. and foreign shipyards. Based on the results of questionnaires and personal contacts with the shipyards. evaluations were made of the various organizations and their inherent strengths and weaknesses. From these results, a model organization was developed which is considered to be more efficient at providing zone-oriented design products directly to the production trades. (63 p.) (Project identified as 4-85-1.)

BENEFIT ANALYSIS: LOW VALUE. Over half of those interviewed were familiar with this material, but no application of it was reported. One person said, "We tried to follow up on it with Phase II, but we never got to the implementation stage - we never made it". Another said that it was curiously interesting that "only now are (Naval) shipyards reorganizing".

NSRP 0285 **

TITLE: Interface Impacts System to Zone Transition.

AUTHOR: Todd Pacific Shipyard Corporation for Newport News Shipbuilding.

DATE: May 1989 *COST:* $71,531.

ABSTRACT: The productivity of the U.S. commercial shipbuilding industry has been analyzed and established as approximately half that of the leading foreign competition. In contrast, the productivity of the U.S. naval shipbuilding industry is not well documented. Methods used in constructing naval combatant ships need to be analyzed and evaluated so efforts to improve productivity can be focused on specific problems and opportunities. Technology transfer of the Ishikawajima-Hanma Heavy Industries (IHI) System is generally directed towards commercial shipbuilding. Naval shipbuilding has far different constraints that impact producibility improvements during the design process and the construction of the naval ship. Todd Shipyards made a decision to implement one of the IHI principles, Zone Outfitting Methods (ZOFM), on an FFG Class Frigate and compare actual production information with that of an early ship (FFG- 19) constructed in accordance with conventional shipbuilding methods. This report is a result of that study. (90 p.) (Project identified as 4-84-4.)

BENEFIT ANALYSIS: LOW VALUE. *56%* of those questioned had no knowledge of this report and no interest in the material. One other person said that he “has read anything to do with zone logic”. Another person said that he “did not have a good feeling about this one”. A third person said that he had read the report with great interest, but that “it was large, and I could not find the bottom line”.

NSRP 0286 **

TITLE: Zone-Oriented Drawings for Life Cycle Management.

AUTHOR: Wilkins Enterprise, Inc. for Newport News Shipbuilding.

DATE: September 1988 *COST:* $40,178.

ABSTRACT: This report records the results of a study conducted to determine whether the drawings being developed and used by shipbuilders using modem zone oriented (modular) construction techniques will satisfactorily meet the needs of each of the U.S. Navy's organizations having some type of responsibility in the Navy's life cycle maintenance management process. The question was raised because certain of these drawings are very different from the type of system-oriented drawings developed and used by shipbuilders in the past. The report provides recommendations for the type of formation which must be provided in drawings of various types to best meet the needs of the life cycle management process. (52 p.) (Project identified as 4-84-2.)

BENEFIT ANALYSIS: LOW VALUE. This report was familiar to 56% of those interviewed, but none of them indicated any application of the material. One said it was "theoretical and not useful". Another said it was "more of a Navy-type project".

NSRP 0293 * * *

TITLE: The Information Flow Requirements for Integrating Schedules for Drawing Development and Equipment Procurement in Shipbuilding Programs.

AUTHOR: Newport News Shipbuilding Company,

DATE: June 1989 *COST:* $77,996.

ABSTRACT: This report describes the principle purpose of work performed in order to develop tools that are necessary for integrating the schedules by which drawings are developed and equipment is procured in shipyards. (86 p.) (Project identified as 4-84-3.)

BENEEIT ANALYSIS: LOW VALUE. 56% of those interviewed had no knowledge of this report and no interest in the material. 33% had read the report. but intended no application of it. One of those commented that the material was "theoretical and not useful". One other person said that he had found the report to be a good one, and added that he wished his shipyard would make more use of it.

NSRP 0300 * * * * * * *

TITLE: Advanced Measurement Techniques for U.S. Shipbuilding.

AUTHOR: National Steel and Shipbuilding Company.

DATE: March 1990 *COST:* $81,831.

ABSTRACT: Modem shipbuilders have embraced the concept of modular construction and are realizing the gains in productivity associated with these methods. Further gains in productivity can be achieved if these modules can be built and erected "neat," that is, without the traditional excess material normally trimmed at erection. Construction of a "neat" hull block requires rigid control of accuracy throughout the production cycle. Interim products from the fabrication of parts through the erection of hull block must be carefully measured to strict tolerances in order to assure minimal rework. (125 p.) (Project identified as 4-85-2.)

BENEFIT ANALYSLS HIGH VALUE. 44% of those interviewed had read the report, found the material to be good information, but said that their shipyards intended no application of it. One shipyard representative reported use of this material as a baseline in his accuracy control group. He stated that the report had been helpful in justifying the system currently in use at his shipyard, which was the one most highly rated in the report. Another interviewee cited his own personal use of the material at his shipyard as reference information.

NSRP 0319 * * *

TITLE: Investigation of the Application of Computer Aided Process PIanning to Ship Modernization, Overhaul and Repair.

AUTHOR: H. L. Young and M. R. Gluse

DATE: May 1991 *COST:* $69,102.

ABSTRACT: The purpose of this study is to investigate and evaluate the use of Computer Planning, the extension of Group Technology concepts, to ship repair and modernization. Industry experience has demonstrated that when computer-aided process planning is applied to a zone-based, product oriented work structure, significant cost savings can be realized. (75 p.) (Project identified as 4-87-3.)

BENEFIT ANALYSLS: LOW VALUE. This report was familiar to 44% of those interviewed, but they cited no application of the material. One person said he wished that his shipyard would use this technique, but that they simply did not have the money needed to carry it out.

NSRP 0323 * * * * *

TITLE: Information Required from PIanning Yards to Support Zone Logic.

AUTHOR: Richard Storch and L. D. Chirillo.

DATE: June 1991 *COST:* (Not available)

ABSTRACT: This report has gathered information from planning yards on how to support zone logic. It recommends ways to improve the manufacturing system and how to develop generic strategies per ship class. Also discussed are the importance of establishing production engineering in planning yards and institute zone oriented design stages and the implementation of product oriented material management. The study recognizes planning yard activities as part of the manufacturing system. (93 p.)

BENEFIT ANALYSIS: MIXED VALUE. 1/2 of the people interviewed had no knowledge of this report and no interest in the material. 44% had read the report. but intended no application of it. One shipyard representative said that the report had "sparked some action in our planning area". and that it was useful to those trying to make improvements in the planning process.

NSRP 0333 * * * * * *

TITLE: The Definition of a Shipyard's Engineering Requirements to be Met by a Design Agent.

AUTHOR: James Wilkins

DATE: July 1991 *COST:* (Not available)

ABSTRACT: This report provides a generic listing of the requirements for a shipyard's engineering support contract. The generic list of requirements was developed in conjunction with eight shipyards and five design agents. The report details the goals, approach and conclusions of the study. (41 p.)

BENEFIT ANALYSIS: MIXED VALUE. 1/2 of those interviewed were familiar with this report. Only one shipyard representative cited application of it, adding that use of the material was on-going and effective. One other person was not as generous in his comments, saying that the report "could have been better". He stated that part of the problem was the practice of sending out questionnaires to interview people in shipyards. Such "shotgun surveys are shaky, because the people who decide to participate often have their own agendas" which bias the results.

MANAGEMENT OF SPC PANEL SP-4 ACTIVITIES

General Discussion

This section describes the opinions of those interviewed relative to the administration of SPC Panel SP-4 meetings, including such things as the use of pre-planned agenda, the actual format for a meeting, who should attend, how often a meeting should be held and under what circumstances (e.g., during the same time frame as the meeting of another SPC Panel, or an NSRP Symposium), what matters should/should not be discussed, how meeting minutes should be handled, and similar considerations that bear on the mechanics of the panel meeting itself It also describes the thoughts of those interviewed on how the NSRP can be of more assistance to them, what projects should be prosecuted, and in general what message they would like to have transmitted back to Panel SP-4.

The discussions that produced these opinions were open and direct. The persons interviewed constitute the shipyard core of Panel SP-4 as it is known today, and so their feelings are surely important to the future well-being of the Panel and its activities.

On the following two pages is a matrix showing SPC Panel SP-4 Meeting Attendees for the 10 most recent meetings. This matrix reveals which shipyards and other activities have been supporting SP-4 by having a representative in attendance at these meetings. The date and location of each meeting is indicated, along with the company affiliation of those in attendance. Note that 45% of these companies have had a representative at three at more of these meetings. However, only slightly more than 1/3 of this group, who comprise the fairly regular attendees, are shipyards. Clearly, shipyard representation at Panel SP-4 meetings has been in the minority.

Attendee Affiliation / Date - Location	Dec '89 - San Diego, CA	Apr '90 - Norfolk, VA	Aug '90 - Sparrows Point, MD	Mar '91 - Carderock, MD	Jul '91 - Carderock, MD	Oct '91 - Pascagoula, MS	Mar '92 - Carderock, MD	Jul '92 - Saint John, NB	Mar '93 - Newport News, VA	Jul '93 - Bath, ME
Advanced Management Catalyst, Inc.										X
Astilleros Espanoles										X
Atlantic Dry Dock									X	
Atlantic Marine, Inc.									X	
Bath Iron Works						X	X	X	X	X
Bethlehem Steel Corp.	X	X	X	X	X	X	X	X	X	X
BMS and Associates	X	X						X	X	
BMT International, Inc.					X					
Borchers & Associates	X									
BWS/ACMAN										X
CDI Marine Co.		X	X	X	X	X	X			
Coastal Group Technology			X	X			X	X	X	
Digital Equipment Corp.					X	X	X			
DTRC (NSWC - Carderock)	X		X	X	X	X	X	X	X	
Enterprise Assistance, Inc.		X	X	X	X			X	X	
George G. Sharp									X	
IBM Corp.							X	X		
Ingalls Shipbuilding Div.	X	X	X	X	X	X		X	X	X
JJG Associates			.		X				X	
JJH Inc.	X	X								
JJMA		X				X				
Jonathan Corp.		X		X	X		X		X	X
M. Rosenblatt & Son									X	
Managing Change, Inc.				X						
Maritime Administration, U. S. DoT				X		X	X	X		
NASSCO	X	X		X	X	X	X	X	X	X
Naval P G School - Monterey						X		X		X
NavSea			X	X	X	X	X	X	X	X
Newport News Shipbuilding	X	X	X	X	X	X	X	X	X	X
Norfolk NSY										X
Pro-Link, Ltd.										X
Puget Sound NSY									X	X
Ross-McNatt Naval Architects									X	X
Saint John Shipbuilding Ltd.					X	X	X	X		X

Minutes of the Nov '93 meeting in San Diego, CA do not include a list of attendees.

Meeting Attendees
SPC Panel SP-4
Design/Production Integration

Attendee Affiliation / Date - Location	Dec '89 - San Diego, CA	Apr '90 - Norfolk, VA	Aug '90 - Sparrows Point, MD	Mar '91 - Carderock, MD	Jul '91 - Carderock, MD	Oct '91 - Pascagoula, MS	Mar '92 - Carderock, MD	Jul '92 - Saint John, NB	Mar '93 - Newport News, VA	Jul '93 - Bath, ME
SPAR Associates									X	X
Textron Marine Systems				X	X	X	X	X	X	
Tidewater Naval Architects									X	
U. Michigan	X								X	
VIBTECH									X	
Wilkins Enterprise, Inc.	X	X	X	X	X	X	X	X	X	X

Minutes of the Nov '93 meeting in San Diego, CA do not include a list of attendees.

Meeting Attendees
SPC Panel SP-4
Design/Production Integration

Detailed Discussion of Findings

The responses are summarized under the headings of each question, following the order and language of the worksheet, Appendix B, that was used during the interviews.

PANEL MEETINGS AND ADMINISTRATION

How often do you attend?

2/3 of those interviewed had attended all recent meetings. 2 people interviewed had never attended a meeting, but were familiar with the activities of the Panel, and with the reports of the project that have been sponsored by Panel SP-4.

Do/should others in your Company attend?

All of those responding to this question felt that they should attend the meetings alone, and that there was no need for others from their shipyards to attend.

Are the meetings of value to you?

All of the respondents answered this question favorably. Several comments were made during the discussion of this question that illustrate what sort of "values" are involved here. Two of these comments are presented below, as nearly verbatim as possible:

- A principal value of the meetings is the networking that takes place among the attendees.
- The meetings are valuable because they provide contacts with industry people in other shipyards from which we can find out where they stand on certain items. We gain exposure to other shipyards, and can discuss candidly matters of mutual interest.

How can the meetings be improved? In particular,

Increase/decrease number of meeting days?

1/3 said that a meeting duration of 1 -1/2 to 2 days was appropriate. Another 1/3 said 2 to 3 days was best. One person said 2 days maximum, while another person said 3 days would be needed if the meeting is joint with another Panel. There was general agreement that meetings should be held 3 times per year.

Continue/change meeting format?

44% said that no changes were needed, and 66% voiced no opinion.

Continue/change content of meeting?

Responses to this question indicated satisfaction with the present meeting content, with one interviewee adding that the meeting duration could be longer in order to get the work done.

Broaden/restrict who should attend?

1/3 of those interviewed cited the present mix of attendees at Panel meetings as satisfactory. There were, however, several comments from the rest of those interviewed, as follows:

- Keep the "pushers" under control.

- We did have a problem with too few shipyards, but our letter campaign has corrected that situation. Naval shipyard attendance was a problem (too few), then it was OK, but now it is a problem again.

- Too many consultants, and not enough shipyards. Our last meeting (Mar '93) was better due to the prospect of more project money. But we still need more shipyards, including the smaller ones.

- There might be too much coming from the "Beltway Bandits", and not enough from the shipyards. This is a problem today.

- Perhaps we need more people from the academic community in all Panels (including SP-4).

- The Panels might work better if they were smaller in size. We may even need to limit the size, and use an invitation-only arrangement, or else assign memberships.

What should be added to the agenda?

One specific suggestion was made in response to this question, as follows:

- Panel SP-4 should assist in deciding how to use ARPA (Advanced Research Project Agency) finding opportunities.

What should be dropped from the agenda?

The consensus here was that "nothing" should be dropped from the agenda.

Should meetings be held in conjunction with other organizations?

56% of those interviewed said that holding a meeting in conjunction with other SPC Panels, or during the same time frame as a related technical/NSRP symposium, would be worthwhile. 2 interviewees said that Panel meetings should not be coupled to other activities. The rest offered no opinion. Specific comments on this matter were as follows:

- Meetings with other groups are not as good. The meeting becomes too large.

- The recent meeting (Mar '93) with SP-4 and SP-8 (SPC Panel SP-8 on Industrial Engineering) was good. We extended by one day, and held the joint meeting in the middle.

- Probably we should stay with the NSRP groups for joint meetings, and use people from other organizations as guest speakers at our individual Panel meetings in order to cross-pollinate.

- It was good to meet with SP-8 recently (Mar '93). Exposure to other Panels is good. Project comparisons and intelligence was good; it helped to avoid overlaps.

- Joint meetings leave the Panel with less focus. It is probably better with only one Panel.

- Most of our meetings have been independent, but we might better have had 1 meeting per year in conjunction with another Panel.

- Interchanges at joint Panel meetings are good. Some people come only for their own Panel, however.

- I am more likely to go if the joint meeting is matched well.

Are meeting minutes of value to you?

67% answered "yes", and 11% said "no". Three specific constructive comments were made in response to this question, as follows:

1. Minutes need to be published earlier.
2. Distribution of the minutes within the shipyard needs to be improved.
3. Minutes are usually better when one person provides them, rather than asking for a volunteer at each meeting.

How can the NSRP be of more assistance to your company?

This question prompted a series of comments which reflect some serious difficulties with the NSRP in general. These comments also illustrate serious concerns on the part of those interviewed for the future of the NSRP and the shipyard industry. These comments are summarized below:

- We need to apply the findings we already have in hand. Application is not something that the NSRP can do for a shipyard. The shipyard must do it for itself The current need is for implementation. We need to overcome the social barriers. We have a social implementation problem, rather than a high technology problem.

- We need to change the perception that the shipyard industry is dying. I would like to see some shipyard get a big contract in the international commercial market - to demonstrate the vitality of the shipyard industry assisted by the NSRP.

- Our initiatives to support the ARPA (Advanced Research Projects Agency) program involved (31%) highly technical issues. This is not what is needed to get us into the international commercial market.

- Push on the higher level people to look at NSRP products. This includes the NavSea 05 and 07 people. For example, we have the AIM (Advanced Industrial Management) initiative in the Naval shipyards. There are real answers available here, if only the senior people will look at them.

- We need projects that are useful to shipyards. We need people who are willing to share information and cost-share projects. This is how NASSCO did NSRP 0300. Getting shipyards to do projects is tough. Consultants do them - and make it Phase I, then Phase II, etc., and suck up all of the money. There is an industry culture problem to be solved.

- We need more information on what is available from the NSRP. We need publicity - spread the word. We should send project reports to the shipyards - to the managers involved is those particular processes - for comment and review, and to find out how applicability can be improved. We should add a section on how to apply, based on the comments received, or include a section that provides the comments from the prospective appliers.

What Projects would you like to see carried out?

78% of those interviewed had specific comments on this question. as follows:

Ž Finite (weekly) scheduling. We have top level and intermediate level scheduling now, but no bottom level scheduling. Bar coding can help enormously.

Ž The costof “non-process activities” continues to be unknown (and should be investigated).

Ž The concept of outfit packaging is promising - teaming with vendors, rather than playing the adversarial role that purchasing puts you in.

Ž How to get the waterfront people and the engineering people more in tune.

Ž Generic sequencing and scheduling using a zone logic approach. This should be menu-driven, and easy to use.

- Studies of European shipyards to learn good ideas.

- Testing of PWBS (Product Work Breakdown Structure).

Ž We need practical projects with production orientation. For example, stud shooting for hangers.

- We do not have enough continuity, year to year, on projects. We redo things that we have already done. This falls out of the way abstracts are offered. People do not think about the continuity of effort.

• The top priority Fy-92 project was a survey of the international commercial market. Still we have no project finding. American Waterways is now saying that they cannot wait any longer, and must do it themselves. Therefore this project will not be as valuable as it would have been.

• We should repackage and massage SP-2 (SPC Panel SP-2 on Outfitting and Production Aids, no longer an active panel) new construction information and apply it to repair work. The focus on kitting and palletizing could apply to repair as well as new construction. Without SP-2 on the scene, why not have SP-4 do this?

• We should focus on material and design standards, unless Panel SP-6 (SPC Panel SP-6 on Marine Industry Standards) picks up this area soon.

Do you have on-going NSRP Projects?

There were no positive responses to this question.

What problem areas would you like to see investigated?

This question was quite similar to the earlier one that asked "What Projects would you like to see carried out?", but prompted a few different responses, as follows:

- Some of the projects that did not make the prioritization by the Panel might still be potentially beneficial. Work station processes and work station development is an example. Process-type projects are other examples - to fully integrate from design to production.

- Very few SP-4 projects are applied. We need more direct implementation projects, and information on how to apply the findings. Concurrent engineering, for example, is a good idea, but we need deliberate information on how to do it in a shipyard.

- SP-4 has lately required an implementation phase on each project. This is an attempt to force an application phase later on.

- Projects are too technical.

- Testing of PWBS was important, but it has not gotten the necessary votes.

What message would you like transmitted to this Panel?

This question was added to the list so that the people being interviewed could have a direct voice back to the Panel, anonymously, on any point that they might wish to raise. There were only two comments offered in the SP-4 area, but each comment addresses a major problem area. Responses were as follows:

• I would like an Ad Hoc Committee to measure implementation of projects at shipyards, to see how much they are being used and how.

Ž Bigger problems get lost in the quantity of abstracts. The major problems of the industry need to be attacked by the ECB (Executive Control Board of the Ship Production Committee of SNAME), with feedback to the Panels to work on them. For examples: lack of standardization; better use of labor producible designs; improved labor skills. The ECB needs to provide assignments to Panels, and then the Panels should manage the solutions.

PROJECT REPORTS AND NSRP INFORMATION

Do you receive adequate information on NSRP Project Reports?

78% of those interviewed answered "Yes", although the remaining 22% answered "No". This rather high percentage of "No" answers came from a group closer to SP-4 activities than most other shipyard people. It is apparent that there is a Problem in getting NSRP reports out to the shipyard people who need to see them.

Do you get the "Yellow Book" NSRP Bibliography of Publications?

Here 67% answered "Yes", and 11% answered "No", with the remaining 22% having no comment. When questioned further, however, all interviewees stated that they had access to this document, even though they did not have their own personal copy.

Have you ever ordered a Report from the NSRP Library?

1/3 of those interviewed had ordered a publication personally, and indicated that they had received the reports promptly and in good order. Similar comments were received about the AVMAST (Audio Visual Material Available for Shipyard Training) Library of training materials. It is clear that the procedure for obtaining project reports and training materials from the NSRP Library is working satisfactorily.

Is the NSRP Newsletter of value to you?

Only *33%* of those interviewed answered this question in the affirmative. 44% answered in the negative. Most of these people saw the Newsletter only when it was routed to them by someone else. 1/3 of those interviewed asked to have their names added to the mailing list for the Newsletter, which is a favorable indication that they feel the Newsletter has the potential of being useful to them. One person would favor a monthly issue of the Newsletter.

How can NSRP information be communicated more effectively?

Since it was apparent at the beginning of this Project that communications were a major weakness of the NSRP, this question was added to explore with those interviewed how improvements might be made. Responses to this question were as follows:

- Target the managers of crafts, and the general superintendent level people. Give information to each shipyard, by means of a presentation and a handout. Then they can carry the messages forward. Workshops should include this kind of information regularly. The AVMAST information also should be promoted.

- Information needs to get to the user level - supervisors, and even workers. This is a shipyard problem, not an external problem. This may be the key to solving the application problem. "We" are unknown to the people who do the applying. We need to promote application and implementation.

- We need a primer in the NSRP Newsletter on how to access the Bibliography (of Publications). We need similar information on how to obtain project reports. Make the process more user-friendly. Publicize the Bibliography at the Panel meetings, at least once a year. We might even use a "Bulletin Board" arrangement.

- "New" people need to find out what the Program has to offer. We must keep working on it.

- Participation is the best way. Otherwise, we must work at it constantly using all available "tools". If those fairly close to the Panel have trouble understanding, then those furtther away will simply give up.

- An "NSRP User's Group" (see next question) could force this communication.

- Shipyards that participate (will) benefit, but other shipyards do not benefit because of the communication deficiency. Other shipyards need to be involved more effectively - with reports, workshops, newsletters - in order to get in tune.

- We need improved awareness at upper and near-upper management levels of what the NSRP is doing, in order to let them know what is happening - and where.

- We need broader dissemination of the quarterly NSRP Newsletter. It should be copied locally, and transmitted to all middle management. A simple bullet-type newsletter would be more effective. Keep it simple, and send it everywhere.

Would you prefer to have a single point of contact within your company for information on meetings, availability of NSRP reports on projects, and other NSRP matters?

This question was included on the list to suggest the idea of a single point of contact to those who have not as yet tried it. It would also provide some feedback from those who have attempted this idea in their shipyard. Responses were as follows:

Ž This is a good idea. We have held one meeting (of such a focus group) already.

• Yes. We would like to have a group of users involved.

Ž If so, careful attention must be given to selection of the key figure. We tried it years ago, but it did not work well.

• Yes. We have such a point of contact now.

Ž This would be OK but the users will not know that they should contact the point of contact. We still have to solve the general awareness problem.

What person in your company would best serve as this point of contact?

This follow-up question prompted the following responses:

Ž The NSRP Program Manager, who is (resident) at our shipyard.

Ž This would be a management position, filled by someone active with the NSRP and the SPC Panels.

● This would probably be Code 300.1 in a Naval shipyard.

CONCLUSIONS FROM THE FINDINGS

Analysis of the responses offered by those interviewed suggests the following conclusions on matters of interest to SPC Panel SP-4.

Those Associated with the Benefits derived from Project Reports

1. The projects yielding the MOST benefit value were those where development of the findings involved direct shipyard participation.

2. The projects involving theoretical, philosophical, and analytical matters were considered low in value.

3. Too few projects have been implemented within the shipyard community, This problem has two components: lack of awareness that NSRP/Panel SP-4 findings exist; and lack of resources and opportunities to apply the findings.

Those Associated with the Suitability of Panel Meeting Administration

4. The present administration of Panel Meetings is satisfactory, and should be continued with only minor adjustments.

5. Several specific points are pertinent:

A. Meetings of 1-1/2 to 2 day's duration, three times per year, at varying locations, are favored. Meeting duration's might be lengthened by 1 day as the agenda dictates, but should not be shortened.

B. The present meeting format and content have been satisfactory and should be continued.

C. The present mix of attendees is not satisfactory, because non-shipyard influences are in the majority and are dominating Panel deliberations.

D. Meeting agenda items are satisfactory, and should be continued.

E. One meeting per year in conjunction with another SPC Panel would be favored by the membership, provided adequate exclusive time is allowed for Panel SP-4 business.

F. Meeting minutes published sooner, and taken by the same person at each meeting, would be beneficial. In addition, improvement is needed in the distribution of meeting minutes within the shipyards receiving them.

Those associated with the Administration of Project Reports and Information

6. Improvement is needed in making project reports available to the shipyard people who need them, specifically those who are in a position to apply the findings.

7. The NSRP Bibliography of Publications has been available to those who need it.

8. The procedure for obtaining project reports and training materials from the NSRP Library has been working satisfactorily.

9. Distribution of the NSRP Newsletter is too narrow and restricted.

10. A single point of contact within a shipyard for obtaining information on NSRP matters would be helpful.

Those associated with NSRP matters in general

11. Actual application within the shipyard community of NSRP project results is small and irregular.

12. Efforts to prepare the shipyard community for entry into the international commercial market appear to lack focus and direction.

13. Communications with shipyard people on what is available to them from the NSRP/SPC Panels are weak, and do not-reach enough members of the using community.

14. In summary, SPC Panel SP-4 is active, supported by a growing number of shipyards, and is endeavoring to provide contributions to the National Shipbuilding Research Program in behalf of the shipyard community in the area of Design/Production Integration. More extensive and effective application of research results by shipyard users is being pursued.

RECOMMENDATIONS FROM THE CONCLUSIONS

The following recommendations have been drawn from the conclusions.

Those Associated with Panel Projects

1. The voting members of Panel SP-4 should continue to weigh the potential for implementation of each proposed project, and to temper their decisions accordingly. Workshops and other opportunities for communicating research results should receive prime consideration. Studies offering little practical application in shipyard production or operations areas should have other advantages and prospects of major proportions before they are supported.

Those Associated with Panel Meeting Administration

2. The present practices for Panel meetings should be continued, with only minor adjustments (see pages 27 and 28 under Conclusions for a discussion of several pertinent points).

3. Recent efforts to increase the number of shipyard representatives at Panel meetings should be continued and expanded. Concurrently, steps should be taken to maximize the contributions available from the shipyard representatives in attendance.

Those Associated with the Administration of Project Reports and Information

4. The distribution of project reports to shipyard people, particularly those who are in a position to apply the findings, should be studied and improved.

5. Extension of the NSRP Newsletter to a broader distribution, and the introduction of timely feature articles of interest to most readers, should be supported.

6. The idea of establishing of a single point of contact within each shipyard for NSRP information should be developed and implemented.

Those Associated with NSRP Matters in General

7. Activities that will improve the application of NSRP research results within the shipyard community should receive prime consideration and support.

8. The question of how best to prepare the shipyard community for entry into the international commercial market should be discussed and developed until a comprehensive and workable plan emerges that can and likely will, be supported by the shipyard industry.

APPENDIX A

Project Benefit Analysis Worksheet

SPC Panel SP-4

SP-4 PROJECTS LISTING

NSRP	KEY	REMARKS
0122 Shipbuilding Design/Production Workshop Vol I and II 1981		
0148 Design/Production Integration 1982		
0197 Software Tools for Shipbuilding Productivity 1984		
0236 Design for Production Manual 3 Volumes 1985		
0255 Product Work Classification and Coding 1986		
0258 Specification-Driven Pipe Detail Design 1989		
0266 Computer Aided Process Planning for Shipyards 1986		
0259 Implementation of Advanced Technology in the Shipbuilding Industry - Pilot Workshop Report 1987		

NSRP		SP-4 KEY	REMARKS
0274	Shipyard Engineering and Planning Organizations 1987		
0285	Interface Impacts System to Zone Transition 1989		
0286	Zone-Oriented Drawings for Life Cycle Management 1988		
0293	The Information Flow Requirements for Integrating Schedules for Drawing Development and Equipment Procurement in Shipbuilding Programs 1989		
0300	Advanced Measurement Techniques for U.S. Shipbuilding 1990		
0319	Investigation of the Application of Computer Aided Process Planning to Ship Modernization Overhaul and Repair May 1991		
0323	Information Required from Planning Yards to Support Zone Logic Jun 1991		
0333	The Definition of a Shipyard's Engineering Requirements to be Met by a Design Agent Jul 1991		

KEY	RATING DESCRIPTION
0	No knowledge/ no interest
1	Interested; will look at information
2	Have information; considering it
3	Have studied information; no application intended
4	Information looks useful; application planned
5	Applied once; no further application seen
6	Have applied on limited scale; may apply again
7	Have applied substantially; information useful
8	Constant application on-going; information valuable
9	Need more information; wider application

RATING SYSTEM FOR NSRP PROJECTS EVALUATION

APPENDIX B

SPC Panel Meeting
Management and Administration

Questionnaire/Worksheet

NATIONAL SHIPBUILDING RESEARCH PROGRAM

\+ + +

PROJECT BENEFIT ANALYSIS

and

EVALUATION OF PANEL MEETINGS AND ADMINIINISTRATION

\+ + +

INTERVIEW QUESTIONNAIRE

Date _____

Shipyard Coded Identity _____

(Note: Shipyard identity will not be revealed in the published report.)

Shipyard/Company Name _____

Location/Address _____

_____

Persons Contacted			
Position/Title			
Mailing Address			
Telephone			
Panel Interest			

Shipyard/Company Size (#) _____ Production Workers (#) _____

Ship Types _____

_____

New Construction (Y/N) _____ Repair (Y/N) _____ Union (Y/N) _____

Current Workload Size _____

_____

Remarks _____

_____

_____

_____

_____

QUESTIONNAIRE

Panel SP-_____

Name_____Company_____Date_____

PANEL MEETINGS AND ADMINISTRATION

How often do you attend _____

_____

Do/should others in your Company attend _____

_____

Are the meetings of value to you _____

_____

How can the meetings be improved _____

_____

Increase/decrease number of meeting days _____

Continue/change meeting format _____

Continue/change content of meeting _____

Broaden/restrict who can attend _____

What should be added to the agenda _____

_____

What should be dropped from the agenda _____

_____

Should meeting be held in conjunction with other organizations_____

Are meeting minutes of value to you _____

_____

How can the NSRP be of more assistance to your company _____

_____

_____

What Projects would you like to see carried out _____

Do you have on-going NSRP Projects (identify) _____

What would you like to see investigated - problem areas _____

What message would you like transmitted to this Panel _____

PROJECT REPORTS AND NSRP INFORMATION

Do you receive adequate information on NSRP Project Reports _____

Do you get the 'Yellow Book' NSRP Bibliography of Publications __

Have you ever ordered a Report from the NSRP Library _____

Is the NSRP Newsletter of value to you _____

How can NSRP information be communicated more effectively _____

Would you prefer to have a single point of contact within your company for information on meetings, availability of NSRP reports on projects, and other NSRP matters? _____

What person in your company would serve best as this point of contact?

APPENDIX C

SPC Panel SP-4 Projects Listing based on Benefits Evaluation

APPENDIX C

SPC Panel SP-4 Projects Listing based on Benefits Evaluation

This is an abbreviated listing of SPC Panel SP-4 projects, based on the benefit value (number of*'s) assigned to each project, highest to lowest. This listing is included as an aid to understanding which types of projects were found to be of most (and least) interest and value to the using community, based on the user comments received during this survey.

NSRP 0236 * * * * * * * * *
TITLE: Design for Production Manual -3 Volumes.
AUTHOR: Bethlehem Steel Corporation, Sparrows Point, A and P Appledore Ltd. and J.J. Henry Co.. Inc. for Newport News Shipbuilding.
DATE: December 1985 *COST: $125.000.*

NSRP 0300 * * * * * * *
TITLE: Advanced Measurement Techniques for U.S. Shipbuilding.
AUTHOR: National Steel and Shipbuilding Company.
DATE: March 1990 *COST:* $81,831.

NSRP 0333 * * * * * *
TITLE: The Definition of a Shipyard's Engineering Requirements to be Met by a Design Agent.
AUTHOR: James Wilkins
DATE: July 1991 *COST:* (Not available)

NSRP 0255 * * * * *
TITLE: Product Work Classification and Coding.
AUTHOR: Todd Shipyards Corporation, Seattle, for Newport News Shipbuilding.
DATE: June *1986* *COST:* $139,750. (Phase 2.) (Phase 1 not available.)

NSRP 0323 * * * * *
TITLE: Information Required from Planning Yards to Support Zone Logic.
AUTHOR: Richard Storch and L. D. Chirillo.
DATE: June 1991 *COST:* (Not available)

NSRP 0122 * * * *
TITLE: Shipbuilding Design/Production Integration Workshop. Vol. I and II.
AUTHOR: Panel SP-4.
DATE: January 1981 *COST:* (Not available)

NSRP 0148 *** * * ***
TITLE: DesignfProduction Integration.
AUTHOR: Newport News Shipbuilding.
DATE: March 1982 *COST:* (Not available)

NSRP 0266 * * *
TITLE: Computer Aided Process Planning for Shipyards.
AUTHOR: Bath Iron Works Corporation, for Newport News Shipbuilding.
DATE: August 1986 COST: $68,337.

NSRP 0274 * * *
TITLE: Shipyard Engineering and Planning Organizations.
AUTHOR: Bath Iron Works Corporation.
DATE: August 1987 *COST:* $62,780.

NSRP 0293 * * *
TITLE: The Information F1ow Requirements for Integrating Schedules for Drawing Development and Equipment Procurement in Shipbuilding Programs.
AUTHOR: Newport News Shipbuilding Company.
DATE: June 1989 *COST:* S77,996.

NSRP 0319 * * *
TITLE: Investigation of the Application of Computer Aided Process P1anning to Ship Modernization, Overhaul and Repair.
AUTHOR: H. L. Young and M. R. Gluse
DATE: May 1991 *COST:* $69,102.

NSRP 0197 **
TITLE: Software Tools for Shipbuilding Productivity.
AUTHOR: Grumman Data Systems Corp.. for Newport News Shipbuilding.
DATE: December 1984 *COST:* $52,340.

NSRP 0258 **
TITLE: Specification-Driven Pipe Detail Design.
AUTHOR: Ingalls Shipbuilding, Inc. for Newport News Shipbuilding.
DATE: July 1989 *COST:* $82,742.

NSRP 0285 **
TITLE: Interface Impacts System to Zone Transition.
AUTHOR: Todd Pacific Shipyard Corporation for Newport News Shipbuilding.
DATE: May 1989 *COST:* $71.531.

NSRP 0286 **
TITLE: Zone-Oriented Drawings for Life Cycle Management.
AUTHOR: Wilkins Enterprise, Inc. for Newport News Shipbuilding.
DATE: September 1988 *COST:* **$40,178.**

NSRP 0259 *
TITLE: Implementation of Advanced Technology in the Shipbuilding Industry - Pilot Workshop Report.
AUTHOR: The University of Michigan for Newport News Shipbuilding.
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NSRP Coordinator
The University of Michigan
Transportation Research Institute
Marine Systems Division
2901 Baxter Rd.
Ann Arbor, MI 48109-2150
Phone: (313) 763-2465
Fax: (313) 936-1081